

GALLS ON STEMS OF CULTIVATED BLUEBERRY  
(*VACCINIUM CORYMBOSUM*) CAUSED  
BY A CHALCIDOID, HEMADAS  
NUBILIPENNIS ASHM.<sup>1</sup>

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EXPERIMENT STATION

The reniform, pithy, polythalamus galls commonly found on the stems and branches of several species of *Vaccinium* have been quite abundant for the past several years on cultivated blueberries in New Jersey. The Sam variety of *V. corymbosum* seems to be particularly susceptible to the formation of this gall. In one field planted to this variety, nearly all of the plants were found to have galls in 1925 and 1926. During the season of 1926, another variety (Harding), planted alongside the Sam variety, was found infested but to a less extent than the latter.

Specimens of the galls sent to the office of the State Entomologist of New York were determined as those of the cynipid, *Solenozopheria vaccinii* Ashm. Specimens of the galls, and five different species of chalcidoids that were reared from them, were sent to the National Museum at Washington, D. C. The galls were determined either as parasites on the gall maker or as "guest flies." Dr. A. B. Gahan, of the National Museum, expressed some doubt whether the galls were caused by the cynipid to which they are commonly ascribed. He thought it probable that the galls were caused by *Hemadas nubilipennis* Ashm., a species commonly reared from the galls.

Lack of knowledge concerning the life history and habits of the gall maker has been a handicap in devising suitable control measures. The experiments reported at this time were carried on in an effort to isolate the true gall maker and to gain some knowledge of its life history.

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## HISTORY OF THE GALL

In 1887, Dr. W. H. Ashmead published a description of the gall in *Transactions of the American Entomological Society*, volume 14. He described the gall as a "reniform, pithy gall on the stem or branches of *Vaccinium corymbosum* and *V. pennsylvanicum*." Dr. Ashmead bred one female cynipid from the galls in February, 1886. He set up a new genus and species, naming the insect *Solenozopheria vaccinii*. The formation of the gall was ascribed to this species.

The writer has tried to rear the cynipid in question from hundreds of galls but with no success. Inquiry revealed the fact that others had made numerous attempts to rear the supposed gall maker but had failed.

Besides the single cynipid specimen, Dr. Ashmead named and described three chalcidoids that were reared from the *Vaccinium* galls. The three species which are commonly reared from the galls are: *Hemadas nubilipennis* Ashm., *Ormyrus vaccinicola* Ashm. and *Eurytoma solenozopheriae* Ashm. Dr. Ashmead thought these chalcidoids were either parasites or guest flies.

## REARING EXPERIMENTS

In the winter of 1925-1926 and the spring of 1926, the writer collected 400 galls from a cultivated variety of *Vaccinium corymbosum*. Collections were made up to the first week in May, 1926. All the galls were placed in one large cage and the insects allowed to emerge throughout the spring and summer of 1926. Most of the galls, and especially those collected the first week in May, had quite a number of exit holes when collected, indicating that some of the insect inhabitants had already emerged. Previous observations had shown that a few individuals of the two species, *Eurytoma solenozopheria* Ashm., and *Ormyrus vaccinicola* Ashm., emerge in the fall of the same year in which the galls are formed. The number of individuals of each species that had emerged were recorded from time to time through the summer. The data are set forth in table 1. It was observed that the peak of emergence for *Hemadas nubilipennis* Ashm. occurred about the time the blueberry plants were putting out new vegetative

growth. The peak of emergence for *Decatoma* sp. came about two weeks after the peak of emergence for *Hemadas*. The other three species were never very numerous and were found to emerge over a longer period of time.

TABLE 1

SPECIES OF CHALCIDOIDS EMERGING IN 1926 FROM 400 GALLS FORMED IN THE SUMMER OF 1925

| Species                                   | No. of individuals found to have emerged at different dates |         |        |         |          |
|---|---|---------|--------|---------|----------|
|   | June 7  | July 15 | Aug. 1 | Aug. 18 | Sept. 21 |
| <i>Hemadas nubilipennis</i> Ashm. ....    | 1,639   | 11      | 0      | 0       | 0        |
| <i>Decatoma</i> sp. ....                  | 891   | 5       | 0      | 0       | 0        |
| <i>Eurytoma solenozopheria</i> Ashm. .... | 184   | 33      | 0      | 0       | 0        |
| <i>Ormyrus vacciniicola</i> Ashm. ....    | 70  | 27      | 0      | 452     | 84       |
| <i>Eupelmus</i> sp. ....                  | 16  | 13      | 0      | 0       | 0        |
| <i>Solenozopheria vaccinii</i> Ashm. .... | 0   | 0       | 0      | 0       | 0        |

An examination of the data in table 1 shows that not a single cynipid was bred out. The data also show that *Hemadas nubilipennis* Ashm. was the most numerous species to emerge. Dr. A. B. Gahan, of the National Museum, informed the writer that he had gotten similar results from rearing experiments. Another interesting point brought out by a study of the data in table 1 is the fact that a second brood of *Ormyrus vacciniicola* Ashm. emerged the first part of August. The individuals of this brood were much smaller than the individuals of the first brood. It is not known whether the eggs of this second brood were deposited in the old galls after the other species had emerged. If such was the case it would indicate that *Ormyrus* is a "guest fly" and not a parasite. No particular observations were made to determine if *Ormyrus* oviposits in the old galls. However, on May 10, the writer observed an *Ormyrus* individual trying to insert her ovipositor in an old gall. The individual was gently moved to a young growing twig but returned to the old gall. This was repeated several times. Another *Ormyrus* individual was found with her ovipositor held fast in an old gall.

### OBSERVATIONS MADE TO DETERMINE WHICH SPECIES OVIPOSIT IN BLUEBERRY STEMS

The writer introduced fresh young stems of the blueberry in a breeding cage containing the five different chalcidoids. *Hemadas nubilipennis* Ashm. individuals immediately began ovipositing in the tender stems. Stems, with ovipositing individuals attached, were placed under binoculars and the ovipositing process observed. In ovipositing, the *Hemadas* individuals would place the anterior end of their body toward the growing end of the shoot. The full length of the ovipositor was inserted in the stem. After each insertion and removal of the ovipositor, the individual would move up the stem a very short distance and insert the ovipositor again. This action was repeated again and again until a row of punctures about an inch long was made in the stem. Several of the stems oviposited in by *Hemadas* were dissected. The bark on the opposite side of the stem from where the punctures were made was peeled off exposing the ends of numerous long white eggs placed crosswise the stem. Numerous twigs with the characteristic *Hemadas* punctures were collected in the field and dissected. Eggs were found in these stems similar to the eggs found in the stems exposed to *Hemadas* under controlled conditions.

Numerous observations were made to see if any of the other species would oviposit in fresh blueberry stems. None of them did. At a later time *Decatoma* sp. individuals were observed ovipositing in stems in which *Hemadas* had deposited eggs. Fresh stems beside the injured stems were ignored by the *Decatoma* individuals.

### EXPERIMENTS TO DETERMINE WHICH SPECIES OF CHALCIDOIDS CAUSE GALLS ON CULTIVATED BLUEBERRIES

Fifty nursery plants of the Sam variety were potted on May 18, 1926. Young shoots on the plants were from one to four inches in length. The fifty plants were divided into five sets of ten plants each and the sets plunged in sand. Suitable cages were constructed over each of the five sets and the sets treated as follows: Set one was left as a check; into set two were intro-

duced fifty *Hemadas nubilipennis* Ashm. individuals; set three was given fifty *Hemadas* individuals, the object being to introduce individuals of the other species after the *Hemadas* individuals had deposited eggs; into set four were introduced 30-35 individuals made up of a mixture of *Eurytoma solenozopheria* Ashm. and *Ormyrus vacciniicola* Ashm.; into set five were introduced 50-60 individuals of *Decatoma* sp. The insects were introduced into the five cages on the morning of May 19, 1926.

The *Hemadas* individuals in sets two and three were noted ovipositing in the new growth shortly after they were introduced. The plants in the five sets were observed on May 25. Those in sets one, four and five were growing normally. The stems on the plants in sets two and three were badly injured by the ovipositing of the *Hemadas* individuals. On May 29, forty *Decatoma*, eight *Eurytoma* and seven *Ormyrus* individuals were introduced into set number three. On June 1, all of the plants in the five sets were removed to a large cage where they were kept for the remainder of the season.

The plants were observed from time to time throughout the growing season. Typical kidney-shaped galls formed on every one of the twenty plants exposed to *Hemadas nubilipennis* Ashm. No abnormal growths appeared on any of the plants in sets one and four. Two globular galls about a fourth of an inch in diameter were formed on one plant in set number five. It will be recalled that this set was exposed to *Decatoma* sp.

All the galls on the plants in sets two, three and five were removed on November 8, 1926, and placed in individual jelly glasses for the purpose of rearing the insects in them. All the plants in the five sets were examined carefully for galls at that time. Twenty-two galls were found on the ten plants in set number two and twenty-two galls on the ten plants in set number three. Two small galls were found on one of the plants in set number five. The plants in set one (check set) and set four (exposed to *Ormyrus* and *Eurytoma*) were free of galls.

DISCUSSION OF THE RESULTS OBTAINED FROM EXPERIMENTS CARRIED ON TO DETERMINE WHICH SPECIES OF CHALCIDOIDS CAUSE GALLS ON CULTIVATED BLUEBERRIES

The galls formed on the plants in sets one and two (exposed to *Hemadas nubilipennis* Ashm.) show conclusively that this chalcidoid is capable of forming galls on blueberry plants. There was a possibility of the plants being exposed to other insects before they were caged and that some other insect was responsible for the galls. This is not probable, however, because the ten plants in set one were carefully screened to keep out insects and no galls developed on any of these ten plants.

The ten plants in set four, exposed to females of *Ormyrus vacciniicola* Ashm. and *Eurytoma solenozopheriæ* Ashm., showed no signs of gall formations. This indicates that neither of these two species is capable of forming galls alone. The inference to be drawn, then, is that these two species are present in the galls either as parasites or as "guest flies."

The two small galls found on one of the plants in set five (exposed to *Decatoma* sp?) seem to indicate that this species is also capable of forming galls on the cultivated blueberry. If *Decatoma* sp. individuals are capable of forming galls, it is surprising that fifty or sixty individuals did not produce more galls on the ten plants than what was found. There is the possibility that the two small galls found on one of the plants in set five were caused by the attack of another insect before the plants were caged. An effort is being made to rear insects from all of the galls formed under the controlled experiments. If *Decatoma* sp. is the only species bred from the two small galls in set five, it will indicate that this species is capable of producing galls on the blueberry.

SUMMARY

Galls on the stems and branches of cultivated varieties of *Vaccinium corymbosum* have become so numerous that control measures are necessary. A study of the records showed that the galls are supposed to be caused by a cynipid, *Solenozopheria vaccinii* Ashm. Rearing experiments carried on for the pur-

pose of isolating the gall maker and learning something about its life history produced only chalcidoids, of which there were five different species. Laboratory observations disclosed the fact that one of the five species, *Hermadas nubilipennis* Ashm., deposits eggs freely in the young, growing stems of cultivated blueberries. In controlled cage experiments, in which separate sets of blueberry plants were exposed to the different species of chalcidoids, it was found that *Hermadas nubilipennis* Ashm. is capable of forming the reniform, pithy galls commonly ascribed to *Solenozopheria vaccinii* Ashm.